forming cumulus clouds. (Davis's Elementary Meteorology, page 263.)

AIR CURRENTS IN THUNDERSTORMS.

It is well known that in general a thundercloud is fed by currents of air flowing toward its center with a gentle ascending gradient that becomes very steep within the cloud itself. But the descending rain both by cooling the air through which it falls and by driving it downward, causes an outward wind near the ground and near the center of the thunderstorm. On August 5 Mr. Wm. A. Eddy, of Bayonne, N. J., sent up a small hot-air balloon at 4:15 p. m. as a heavy thunderstorm was approaching. After ascending vertically for 100 feet it was caught in the current that swept it toward the center of the storm and at the same time it rose until it was fully 2,000 feet above the earth and finally penetrated the cloud with falling rain. It was then driven downward and backward until it reached a point on the earth quite near its starting point. Two other similar experiments with the same results had been made by Mr. Eddy on July 22 and 27.

This is an interesting method of studying the currents of air in the atmosphere. It may not be wholly new, but is well worthy of frequent repetition.

ANCIENT TORNADO TRACKS.

In the August report of the Iowa Monthly Review, Messrs. Sage and Chappel reprint from the Davenport Democrat some account of several tornadoes that must have occurred years ago, whose existence and tracks are demonstrated by long lines of destruction in forests. Such tornado tracks were frequently investigated by Lieut. John P. Finley and included in his tables of tornadoes. The additional ones now recorded are as follows:

Several located by Mr. James E. Lindsay, of Davenport, and E. W. Durant, of Stillwater, in the neighborhood of Davenport. Also, several located by Lindsay in northwestern Wisconsin and Nebraska. The Comanche tornado of 1860. The tornado of Cedar County, June 5, 1854, located by Joseph Wright of Plato, Iowa, who says:

> The path of the storm was half a mile wide as it cut its way through the timber. Everything was taken clean—nothing left. When the storm crossed Cedar River it took large stones from the bottom and carried them on land. From the best information I could gather, this storm of 1854 must have reached Lake Erie.

There is no reason whatever to imagine that the tornado is a new phenomenon. It must have been just as common in North America 5,000 years ago as it is to-day. Every well-marked ancient tornado path that can still be recognized in the fallen timber, or a description of which can be obtained from ancient letters, newspapers, or local records should be put on record.

BACK NUMBERS OF THE MONTHLY WEATHER REVIEW.

The Smithsonian Institution desires two copies each of the MONTHLY WEATHER REVIEW for September, 1897, and September, 1898.

The Public Library at Sydney, New South Wales, desires a copy of the MONTHLY WEATHER REVIEW for November, 1895.

The Meteorological Observatory at Bremen, Germany, desires to obtain the complete years 1897 and 1898.

In general, it is best for those having copies to spare of the MONTHLY WEATHER REVIEW to send them to the Editor of the REVIEW and not to the person for whom the request is made, as in the latter case unnecessary duplicates accumulate on his hands.

THE SECOND WELLMAN EXPEDITION.

Mr. Evelyn B. Baldwin, of the Weather Bureau, who was granted a furlough to enable him to accompany the second Wellman expedition in the capacity of meteorologist, has very recently returned from Franz-Josef Land, and has resumed his duties in the Weather Bureau.

We are authorized by Professor Moore to announce that a report on the meteorological work of the expedition is now in course of preparation and that it will be published shortly by the Weather Bureau.

The region covered by the expedition was mainly between latitude 80° 05′ and 81° 20′ north and longitude 58° to 64° east. The report will include, in addition to hourly barograph and thermograph readings, twice daily eye observations of the clouds, as to amount, kind, and direction; wind movement by Robinson anemometer; observations of the aurora, and other natural phenomena.

Typical pressure and temperature curves, as well as those made during times of unusual atmospheric disturbances, will be reproduced in full. The material collected by Mr. Baldwin is not only interesting and valuable in itself, but also in its relation to the work of former expeditions, since it forms a connecting link between that of Dr. Blessing and Lieutenant Johannsen of the Nansen expedition, as well as that of the Jackson-Harmsworth expedition and work now being prosecuted in Franz-Joseph Land by the Italian expedition under command of Prince Luigi, duc d'Arbruzzi. His aurora work was complementary to that done by himself on the Peary expedition of 1893–94 in Greenland.—*A. J. H.*

A SUCCESSOR TO SENOR BARCENA.

The President of the Republic of Mexico has appointed Manuel E. Pastrana director of the Central Meteorologico-Magnetic Observatory at the City of Mexico as successor to the late Don Mariano Bárcena. The climatology of the Republic is committed to this Central Observatory, but the daily weather telegraphy, maps, and predictions are conducted by the Federal Department of Telegraphs. The stations of the latter organization are new and are in the telegraph offices and convenient to the business men of the Republic, but those of the Central Observatory represent the agricultural and educational interests.

THE WEATHER OF THE MONTH.

By ALFRED J. HENRY, Chief of Division of Records and Meteorological Data.

PRESSURE.

The distribution of monthly mean pressure is graphically shown on Chart IV. The persistence of a West India hurricane off the coast of North Carolina, and the very low barometer readings during the prevalence of the storm explain the unusually low monthly means along the south Atlantic coast. Ordinarily pressure in August is highest on the south Atlantic and north Pacific coasts.

There was a very general decrease in pressure from July to

August, not only on the south Atlantic coast, but also thence northwestward to the north Pacific coast. Pressure rose in the St. Lawrence Valley, but elsewhere except in portions of of California and Nevada there was a general fall.

TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperatures is shown on Chart VI which also shows by appropriate lines the monthly maximum and minimum temperatures. The distribution of monthly mean temperatures was rather abnormal. West of a line drawn from central North Dakota through the center of Arizona, temperature was much below the seasonal normal, while east of the same line, temperature was considerably above the seasonal normal, particularly in northern Texas, Oklahoma, and portions of Kansas and Missouri. The writer does not remember having seen a similar distribution during the last five years.

Maximum temperatures ranging from 100° to 110° in the shade were rather frequently observed in the Southwest, viz: Oklahoma, Texas, New Mexico, and Arizona. Maximum temperatures of 100° and over also occurred in the Gulf States, east of the Mississippi; in South Dakota and elsewhere, as may be seen by an examination of Chart VI. Freezing temperatures occurred in the plateau and mountain regions of northern Nevada, southeastern Idaho, and in northern North Dakota.

In Canada.—Prof. R. F. Stupart says:

The temperature was below average from Vancouver Island to the Qu'Appelle Valley, and above average everywhere else in the Dominion, except over Cape Breton and the Island of Anticosti, where it was from average to over 1° below. In British Columbia and the Northwest Territories it was very much below average, Kamloops reporting as much as 8° below, and Banff and Calgary 6° below. On the other hand, many places in Ontario report the temperature as much as 5° above average, and in the Province of Quebec, Montreal was 3° above, and Quebec City 2° above average.

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	10	67.1	− 0.2	+ 1.1	+ 0.1
Middle Atlantic	12	74.3	+ 1.1	− 0.9	− 0.1
South Atlantic	10	80.6	+ 2.2	+ 0.1	0.0
Florida Peninsula	7	82.4	+ 1.3	+ 2.1	+ 0.3
East Gulf	7	81.8	+ 2.0	− 3.5	− 0.4
West Gulf	7	84.2	+ 3.5	− 2.5	− 0.3
Ohio Valley and Tennessee	12	78.0	+ 3.2	− 0.5	− 0.1
Lower Lake	8	71.7	+ 2.2	+ 3.8	+ 0.5
Upper Lake	9	68.2	+ 2.5	− 3.2	− 0.4
North Dakota	7	65.7	− 0.2	−19.2	− 2.4
Upper Mississippi	11	75.9	+ 3.1	− 6.3	− 0.8
Missouri Valley	10	76.6	+ 3.5	− 9.0	− 1.1
Northern Slope	7	66.5	− 1.3	−26.1	− 3.8
Middle Slope	6	78.7	+ 4.0	− 8.0	− 1.0
Southern Slope	6	83.1	+ 5.7	−10.1	− 1.3
Southern Plateau	13	76.9	− 2.4	− 8.2	− 1.0
Middle Plateau	9	65.7	− 4.7	−13.8	− 1.7
Northern Plateau	10	62.0	− 6.8	−17.2	− 2.2
North Pacific	9	58.8	− 2.9	−14.0	− 1.8
Middle Pacific	5	62.2	− 2.6	− 4.8	− 0.6
South Pacific	4	68.4	− 3.1	− 4.9	− 0.6

PRECIPITATION.

The distribution of precipitation is exhibited on Chart III. Precipitation was in excess of the normal over the Pacific coast States, the northern Plateau, the middle Plateau, the upper Mississippi Valley, the Lake Superior region, the greater portion of the east Gulf States, central Virginia, and thence northeastward over a narrow strip of country extending to southeastern Pennsylvania. Precipitation was greatly deficient from the New England coast westward to the eastern borders of Wisconsin and also over Texas and the Plains northward to the Canadian boundary. There was also a deficiency of precipitation in North Carolina, and thence westward to the lower Ohio and Mississippi valleys. The geographic extent of regions having an excess of precipitation was about equal to that of those having a deficiency.

The drought that had prevailed in New York and elsewhere in the lower Lake region was broken by copious rains about the 26th. Forest fires broke out in the Adirondacks and other places in central New York toward the end of the droughty period. The timely rains at the close of the month greatly aided the authorities in quenching the fires.

In Canada.—Professor Stupart says:

The rainfall was above average from Vancouver Island to the Qu'Appelle Valley and also over the Lake Superior district, and below average throughout the large remaining portion of Canada. The excessive precipitation over British Columbia and the Northwest Territories was remarkable, and more especially in the Territories, where the average amount of precipitation is usually so small. Calgary reports 9.4 inches, nearly equal to the total average annual amount for that district. Edmonton reports 6.4 inches, and Prince Albert 6.8 inches. It was also remarkable, considering the abnormal rainfall in the Northwest Territories, that Manitoba should have had an amount less than the average when that in the Lake Superior district was also above average. Another remarkable feature in the rainfall distribution during the month was the drought over the Georgian Bay district, the lower Lake region and the Ottawa Valley. Some few localities, owing no doubt to local thunderstorms, recorded over two inches of rain, but over the larger portion of these districts scarcely any fell, and some places reported none.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	10	1.97	50	−3.0	−2.5
Middle Atlantic	12	4.20	91	−0.4	−1.9
South Atlantic	10	6.81	100	0.0	−2.3
Florida Peninsula	7	6.03	91	−0.6	−1.7
East Gulf	7	5.83	104	+0.2	−6.6
West Gulf	7	1.13	31	−2.5	−5.8
Ohio Valley and Tennessee	12	2.76	78	−0.8	−3.1
Lower Lake	8	0.85	29	−2.1	−4.9
Upper Lake	9	2.10	70	−0.9	−2.1
North Dakota	7	2.31	100	0.0	−1.0
Upper Mississippi Valley	11	3.51	117	+0.5	+1.7
Missouri Valley	10	3.45	83	−0.7	−3.7
Northern Slope	7	1.34	100	0.0	−0.1
Middle Slope	6	1.84	70	−0.8	+1.4
Southern Slope	6	0.30	11	−2.5	+2.5
Southern Plateau	9	1.09	68	−0.5	−1.7
Middle Plateau	13	1.19	202	+0.6	+1.3
Northern Plateau	10	1.29	331	+0.9	−0.6
North Pacific	9	2.61	287	+1.7	+5.2
Middle Pacific	5	0.27	386	+0.2	−1.7
South Pacific	4	0.02	100	0.0	−1.7

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 13. Arizona, 15, 28, 31. Arkansas, 13, 17, 25. California, 4, 6, 7, 17. Colorado, 2, 3, 5, 6, 13, 14, 16, 17. District of Columbia, 2. Idaho, 8, 13, 20. Illinois, 11, 12, 27. Indiana, 5, 11, 12, 25, 28. Iowa, 1, 9, 11, 18, 23. Kansas, 4, 9, 10, 11, 14, 17, 25, 26. Kentucky, 11, 12, 13, 26. Louisiana, 2, 13, 14, 15, 29. Maryland, 2, 10, 11, 14, 21, 22, 26, 27. Michigan, 11. Minnesota, 10, 11, 31. Mississippi, 1, 25, 28. Missouri, 5, 12, 18, 26, 27. Montana, 5, 7, 10. Nebraska, 1, 2, 3, 9, 10, 12, 13, 16, 18, 19, 26, 29. Nevada, 3, 4, 6. New Jersey, 2, 21. New Mexico, 2, 14. New York, 2, 12, 21, 25, 26. North Carolina, 1, 11, 22. North Dakota, 1, 9, 17, 28. Ohio, 2, 5, 11, 12, 21, 25, 26. Oklahoma, 14. Oregon, 13, 20, 21, 28. Pennsylvania, 2, 10, 11, 12, 21, 25, 26, 27. South Carolina, 11, 12, 21, 23, 24, 25, 26. South Dakota, 1, 10, 17, 18, 30. Tennessee, 13, 26. Texas, 31. Utah, 16, 30. Virginia, 2, 11, 26. Washington, 9. West Virginia, 2, 12, 27. Wisconsin, 1, 9, 10, 11, 23. Wyoming, 7, 9, 13, 16, 19, 28.

LOCAL STORMS AND TORNADOES.

The month was quite free from destructive tornadoes. Local windstorms of more or less severity occurred in various sections of the country.

A violent local storm of wind and rain, having some of the characteristics of a hurricane, struck the Florida coast about 25 miles east of Apalachicola. Great damage was done to the shipping in the harbor and the buildings on land. At Carrabelle fourteen barks were wrecked and a large number of smaller craft destroyed. Six persons lost their lives.

According to Mr. A. J. Mitchell, Section Director, Florida Climate and Crop Service, the diameter of the storm was not more than 40 miles and its force was expended before it had progressed 50 miles inland. Storms of this character on the Gulf coast are not as infrequent as might be supposed although it rarely happens that so much violence is concentrated along such a short path.

The violent thunderstorms of August 2 in New York, New Jersey, eastern Pennsylvania, Delaware, Maryland, and the District of Columbia were made the subject of a special article which appears elsewhere in this REVIEW.

A series of violent thunderstorms swept across the northern part of Illinois during the afternoon and evening of the 11th.

Mr. C. E. Linney, Section Director, Climate and Crop Service of Illinois, in a communication to the Central Office, says:

> The storm seems to have advanced across Illinois at the rate of more than 45 miles per hour, crossing the State from Scales Mound to Chicago, 153 miles, in three hours and fifteen minutes. In its path much damage was done, although the damage at any one point was comparatively small. Rockford seems to have suffered most. Three lives were lost by lightning during the storm; one at Janesville, Wis.; one at Harvard, Ill., and another in Chicago, Ill. No reasonable estimate can be made of the loss or damage to property, but the reports of loss by lightning thus far received aggregate more than $9,000 and this amount is probably but a small part of the loss actually sustained.

On the evening of the 19th a number of severe local storms swept over portions of Hamlin, Deuel and Brookings counties, S. Dak. One life was lost and many buildings were so damaged as to be unfit for habitation. Probably a half dozen houses and as many more barns and outbuildings were destroyed. Much grain in the shock was damaged by the rain and wind.

An incipient tornado wrecked a house 3 miles east of Gleason, Tenn., on the 26th, killing one man and injuring two others. The funnel cloud did not touch the earth again.

One hundred and thirty lives were lost by lightning during the current month. This is the greatest number of fatal cases of lightning stroke in a single month ever before reported.

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	13	54	n.	Jupiter, Fla	13	52	n.
Basseterre, St. Kitts	7	72	ne.	Little Rock, Ark	25	60	nw.
Cape Henry, Va	16	50	ne.	Louisville, Ky	12	50	n.
Do	17	66	ne.	Mount Tamalpais, Cal.	7	50	nw.
Do	18	54	ne.	Do	14	61	n.
Do	19	60	ne.	Do	16	67	nw.
Cape May, N.J	6	56	w.	Do	20	91	nw.
Charleston, S. C	15	57	ne.	Do	21	71	nw.
Chicago, Ill	11	54	nw.	Do	26	88	n.
Fort Canby, Wash	9	50	se.	Do	27	64	nw.
Hatteras, N.C	16	54	ne.	New York, N. Y	5	64	nw.
Do	17	*	n.	San Juan, Porto Rico	8	66	e.
Do	18	70	se.	Sioux City, Iowa	3	59	nw.
Do	19	50	sw.				

*Anemometer cups blown away; estimated velocity 105 miles.

HUMIDITY.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	82	0	Missouri Valley	68	+1
Middle Atlantic	78	+3	Northern Slope	56	+5
South Atlantic	80	−2	Middle Slope	56	−5
Florida Peninsula	79	−3	Southern Slope	45	−19
East Gulf	81	+1	Southern Plateau	36	−12
West Gulf	71	−3	Middle Plateau	37	+5
Ohio Valley and Tennessee	70	−1	Northern Plateau	52	+9
Lower Lake	67	−3	North Pacific Coast	79	+1
Upper Lake	77	+3	Middle Pacific Coast	63	−5
North Dakota	68	+5	South Pacific Coast	67	+4
Upper Mississippi	71	+1			

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.5	+0.5	Missouri Valley	4.2	+0.1
Middle Atlantic	5.6	+0.6	Northern Slope	4.2	+0.5
South Atlantic	5.1	−0.1	Middle Slope	2.8	−1.0
Florida Peninsula	5.0	−0.2	Southern Slope	1.2	−3.6
East Gulf	4.3	−0.6	Southern Plateau	2.2	−1.2
West Gulf	2.4	−2.0	Middle Plateau	3.4	+1.2
Ohio Valley and Tennessee	4.1	−0.4	Northern Plateau	4.6	+1.6
Lower Lake	3.5	−1.0	North Pacific Coast	6.7	+2.8
Upper Lake	4.6	−0.2	Middle Pacific Coast	3.8	+1.0
North Dakota	3.8	−0.1	South Pacific Coast	2.4	−0.1
Upper Mississippi	4.4	+0.3			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table VII, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and

auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 4,943 thunderstorms were received during the current month as against 4,853 in 1898 and 5,476 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 2d, 302; 26th, 264; 5th, 250; 4th, 244; 10th, 237.

Reports were most numerous from: Pennsylvania, 240; Missouri, 224; Nebraska, 219; Florida, 218.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, 16th to 24th.

The greatest number of reports were received for the following dates: 29th, 12; 30th, 6; 3d and 4th, 5.

Reports were most numerous from: Minnesota, 5; Maine, Montana, New York, and Ohio, 4.

In Canada.—Auroras were reported as follows: Father Point, 6th, 9th, 30th; Quebec, 1st, 13th, 20th, 27th; Minnedosa, 4th, 5th, 30th, 31st; Qu'Appelle, 13th; Medicine Hat, 13th, 27th, 29th; Swift Current, 7th; Prince Albert, 3d, 30th.

Thunderstorms were reported as follows: Sydney, 2d, 9th; Halifax, 20th; Grand Manan, 23d; Yarmouth, 22d, 23d, 27th; Charlottetown, 14th, 16th; Father Point, 4th, 5th, 13th; Quebec, 3d, 4th, 5th, 12th, 13th, 22d, 25th, 31st; Montreal, 12th, 21st, 22d; Rockliffe, 21st; Toronto, 2d, 11th; White River, 11th, 20th, 21st, 29th, 30th; Port Stanley, 10th, 11th, 27th; Parry Sound, 2d, 12th; Port Arthur, 11th, 27th, 28th, 29th; Winnipeg, 10th, 19th; Minnedosa, 10th, 16th, 19th, 22d, 23d, 29th; Qu'Appelle, 9th, 19th; Medicine Hat, 6th, 8th, 9th, 10th, 11th, 13th, 22d, 25th; Swift Current, 6th, 8th, 9th, 10th, 15th, 24th, 25th; Calgary, 5th; Banff, 13th; Prince Albert, 13th, 24th; Battleford, 7th, 9th, 15th, 23d; Kamloops, 6th, 13th; Barkerville, 8th, 11th, 14th, 24th, 26th.

NOTES ON THE WEATHER OF THE WEST INDIES.

Chart VIII shows the distribution of pressure and temperature, and the prevailing winds in the West India region for the month, being a continuation of the series begun in the REVIEW for April, 1899.

The hurricane of August 7–10, described elsewhere in this REVIEW and also in Storm Bulletin No. 1, was naturally the overshadowing feature of the weather of the month. A second disturbance occurred over the Caribbean Sea during the closing days of the month, but beyond a few squalls and some threatening weather no serious consequences resulted.

The rainfall was very heavy in Porto Rico in connection with the hurricane that swept over that island. A little over 9 inches of rain fell at Port of Spain, but elsewhere the fall was not heavy. At Havana only 0.14 inch fell during the entire month. Across the island at Cienfuegos 4.44 inches fell, that amount being distributed rather evenly throughout the month.

The greatest number of thunderstorms occurred at Cienfuegos, the observer at that station reporting 21 during the month. At Santiago, on the same side of the island, but 3 thunderstorms occurred, although more rain fell than at Cienfuegos.

Thunderstorms in the West Indies appear to be due almost solely to local causes, such as the breaking up of a condition of unstable equilibrium in the atmosphere and must, therefore, be classed as heat thunderstorms. As such they are not so severe as the cyclonic thunderstorms which occur in the United States.

DESCRIPTION OF TABLES AND CHARTS.

By ALFRED J. HENRY, Chief of Division of Records and Meteorological Data.

For text descriptive of tables and charts see page 317 of REVIEW for July, 1899.